

## **IN THE CLAIMS**

Claim 1 has been cancelled.

1. (Cancelled)

Claim 2 has been amended as follows:

2. (Original) A high gradient stray field magnetic field generator comprising:

a magnetic flux circuit with a yoke and a gap in said yoke that produces a magnetic field; and

an even number of permanent magnets disposed in said gap, forming at least one magnet pair, with the respective magnetizations of the permanent magnets in each magnet pair oriented oppositely to each other, with substantially no open-space separation between the permanent magnets in each pair, said permanent magnets producing a stray field that adds to said magnetic field.

3. (Original) A stray magnetic field generator as claimed in claim 2 wherein the permanent magnets are adjacent to each other with no open space between the permanent magnets.

4. (Original) A stray magnetic field generator as claimed in claim 2 wherein said even number of permanent magnets disposed in said gap is two.

Claim 5 has been amended as follows:

5. (Currently amended) A magnetic write element for longitudinal recording on a recording medium having a surface, comprising:

an inductive write element supplied with a current modulated with information to produce a basic magnetic field embodying said information, said inductive write element having a gap therein; and

an even number of permanent magnets disposed in said gap, forming at least one magnet pair with the respective components perpendicular to the surface of the recording medium of the magnetization vectors of the permanent magnets in each magnet pair oriented oppositely to each other, said permanent magnets producing a stray magnetic field, with a sum of said basic magnetic field and said stray magnetic field forming a write field for recording said information on said recording medium.

6. (Withdrawn) A magnetic write element for perpendicular recording on a recording medium moving in a medium movement direction, comprising:

a single pole write element having a write pole, said write element being comprised of soft magnetic material and being supplied with current to produce a basic magnetic field diverging from the tip of said write pole; and

a multitude of permanent magnets respectively disposed surrounding said write pole with respective magnetization vectors of said permanent magnets having components in a plane parallel with the surface of said medium that are essentially radial to the center of said write pole and in sum essentially equal to zero, said permanent magnets producing a stray magnetic field, with a sum of said basic magnetic field and said stray magnetic field forming a write field for perpendicular recording on said recording medium.

Claim 7 has been amended as follows:

7. (Currently amended) A write head for writing on a pre-magnetized, moving, longitudinal medium, said medium having a surface and a recording layer that is pre-magnetized with a longitudinal pre-magnetization vector in a direction aligned with a direction of movement of said medium, said write head comprising:

a single inductive write element supplied with a current modulated with information to produce a basic magnetic field that embodies said information, said inductive write element having a gap therein; and

two permanent magnets disposed in said gap, ~~with the~~ having respective magnetizations comprising magnetization components perpendicular to the surface of the recording medium of the magnetization vectors of said two permanent magnets that are oriented oppositely to each other, said permanent magnets producing a stray magnetic field within the recording layer of said medium in a direction opposite to the direction of said longitudinal pre-magnetization vector, with a sum of said basic magnetic field and said stray magnetic field forming a write field for recording said information on said medium.

8. (Original) A write head as claimed in claim 7 comprising a spacer disposed between said permanent magnets, said spacer being comprised of spacer material and having a thickness, and wherein each of the permanent magnets is comprised of permanent magnet material, and wherein, the spacer thickness and material and the permanent magnet material are selected to produce the opposite orientation of the respective magnetizations of the permanent magnets by an anti-ferromagnetic exchange coupling between the permanent magnets.

Claim 9 has been amended as follows

9. (Currently amended) A write head for writing on a pre-magnetized, moving medium, said medium having a medium movement direction, a surface and a recording layer that is pre-magnetized with a perpendicular pre-magnetization vector in a direction perpendicular to the surface of said medium, said write head comprising:

a single pole write element having a write pole, said write element being comprised of soft magnetic material and being supplied with a current modulated with information to produce a basic magnetic field, embodying said information, diverging from the tip of said write pole; and

two permanent magnets, disposed on opposite sides, along said medium movement direction, of said write pole with the respective magnetization components parallel to said medium movement direction of the magnetization vectors of the permanent magnets that are oriented oppositely to each other to produce a stray field in a direction opposite to the direction of said perpendicular pre-magnetization vector, with a sum of said basic magnetic field and said stray magnetic field forming a write field for perpendicular recording of said information on said recording medium.

Claim 10 has been amended as follows

10. (Currently amended) A write head for unidirectional overwriting on a medium magnetizable in a longitudinal direction, said medium having a surface and moving in a single medium movement direction, said write head comprising:

an inductive write element supplied with a current modulated with information to produce a basic magnetic field that embodies said information, said inductive write element having a gap therein;

a first magnet pair of two permanent magnets disposed in said gap with respective magnetization comprising magnetization components perpendicular to the surface of the recording medium of said two permanent magnets in said first pair that are oriented oppositely to each other, said first magnet pair producing a first stray magnetic field and the two permanent magnets thereof being composed of permanent magnetic material selected so that a sum of said first stray magnetic field and said basic magnetic field is sufficient to longitudinally magnetize said recording medium only when said inductive write element is supplied with a predetermined current, and to produce substantially no erasure in said recording medium when said write element is supplied with no current or a current that is negative compared to said predetermined current; and

a second magnet pair of two permanent magnets disposed upstream of said inductive write element relative to said direction of medium movement, with respective magnetizations of said two permanent magnets in said second magnet pair comprising magnetization components that are being oriented oppositely to each other in a direction perpendicular to the surface of the recording medium, with the respective magnetizations of said two permanent magnets in said second magnet pair being oriented oppositely to the respective magnetizations of said

two permanent magnets in said first magnet pair, said second magnet pair producing a second stray magnetic field having a strength sufficient to longitudinally magnetize said recording medium for recording said information on said recording medium.

11. (Original) A write head as claimed in claim 10 comprising a spacer disposed between said permanent magnets in each magnet pair, each spacer being comprised of spacer material and having a thickness, and wherein each of the permanent magnets is comprised of permanent magnet material, and wherein, in each magnet pair, the spacer thickness and material and the permanent magnet material are selected to produce the opposite orientation of the respective magnetizations of the permanent magnets in that magnet pair by an anti-ferromagnetic exchange coupling between the permanent magnets in that magnet pair.

12. (Withdrawn) A write head for unidirectional overwriting on a pre-magnetized moving medium, said medium having a surface and a recording layer, said medium moving in a single medium movement direction, said write head comprising:

a single pole write element having a write pole, said write element being composed of soft magnet material, and being supplied with current to produce a basic magnetic field;

a first magnet pair of two permanent magnets respectively disposed one on each side, along said medium movement direction, of said write pole with the respective components parallel to said medium movement direction of the magnetization vectors of said two permanent magnets

in said first magnet pair oriented oppositely to each other, said first magnet pair of two permanent magnets producing a first stray magnetic field and the two permanent magnets thereof being composed of permanent magnetic material selected so that a combination of said basic magnetic field and said first stray magnetic field perpendicularly magnetizes said recording layer with a strength sufficient for recording on said recording medium only for a predetermined current supplied to said write element, and so that substantially no erasure in said recording layer occurs when said write element is supplied with no current or a current that is negative relative to said predetermined current; and

a second magnet pair of two permanent magnets disposed preceding said write element relative to said medium movement direction, the two permanent magnets in said second magnet pair having respective magnetizations oriented oppositely to each other in a direction parallel to said medium movement direction, and the respective magnetizations of the two permanent magnets in said second magnet pair being oriented oppositely to the respective magnetizations of the two permanent magnets in said first magnet pair, said second magnet pair producing a second stray magnetic field and the two permanent magnets thereof being composed of permanent magnetic material selected so that said second stray field has a strength sufficient to perpendicularly magnetize said recording layer in said recording medium for recording on said recording medium.

Claim 13 has been amended as follows

13. (Currently amended) A write head for bi-directional overwriting in a longitudinally magnetized recording layer of a recording medium having a surface, comprising:

a first inductive write element supplied with a current modulated with information to produce a first basic magnetic field embodying said information, said first inductive write element having a gap therein, and a first magnet pair of two permanent magnets disposed in said gap of said first inductive write element with respective magnetizations having components perpendicular to the surface of the recording medium of the magnetization vectors of vectors of said two permanent magnets in said first magnet pair that are oriented oppositely to each other, said two permanent magnets in said first pair producing a first stray magnetic field, with a sum of said first basic magnetic field and said first stray magnetic field forming a first write field for recording on said recording medium;

a second inductive write element, disposed next to said first inductive write element, supplied with said current to produce a second basic magnetic field embodying said information, said second inductive write element having a gap therein, and a second magnet pair of two permanent magnets disposed in said gap of said second write element with respective components perpendicular to the surface of the recording medium of the magnetization vectors of said two permanent magnets in said second magnet pair oriented oppositely to each other,



said second magnet pair producing a second stray magnetic field, with a sum of said second basic magnetic field and said second stray magnetic field forming a second write field for recording said information on said recording medium; and

the respective magnetizations of the two permanent magnets of the first magnet pair being oriented oppositely to the respective magnetizations of the two permanent magnets of the second magnet pair.

14. (Original) A write head as claimed in claim 13 comprising a spacer disposed between said permanent magnets in each magnet pair, each spacer being comprised of spacer material and having a thickness, and wherein each of the permanent magnets is comprised of permanent magnet material, and wherein, in each magnet pair, the spacer thickness and material and the permanent magnet material are selected to produce the opposite orientation of the respective magnetizations of the permanent magnets in that magnet pair by an anti-ferromagnetic exchange coupling between the permanent magnets in that magnet pair.

Claim 15 has been amended as follows

15. (Currently amended) A write head for bi-directional overwriting of a perpendicularly magnetized recording layer of a recording medium moving in a medium movement direction, comprising:

a first single pole write element having a write pole, said first single pole write element being composed of soft magnetic material and being supplied with current modulated with information to produce a basic magnetic field, embodying said information, diverging from the tip of said write

pole, and a first magnet pair of two permanent magnets respectively disposed on opposite sides, along said medium movement direction, of said write pole with respective magnetizations comprising magnetization components parallel to said medium movement direction of the magnetization vectors of the two permanent magnets in said first magnet pair that are oriented oppositely to each other, said permanent magnets producing a stray magnetic field, with a sum of said basic magnetic field and said stray magnetic field forming a write field for perpendicular recording of said information on said recording medium;

a second single pole write element having a write pole disposed next to said first single pole write element, said second single pole write element being comprised of soft magnetic material and being supplied with said current to produce a basic magnetic field, embodying said information, diverging from the tip of said write pole, and a second magnet pair of two permanent magnets respectively disposed on opposite sides along said medium movement direction, of said write pole of said second single pole write element, with respective components parallel to said medium movement direction of the magnetization vectors of the two permanent magnets in said second magnet pair oriented oppositely to each other, said permanent magnets producing a stray magnetic field, with a sum of said basic magnetic field and said stray magnetic field forming a write field for perpendicular recording of said information on said recording medium; and

the respective magnetizations of the two permanent magnets in said first magnet pair being oriented oppositely to the respective magnetizations of the two permanent magnets in said second magnet pair.

16. (Withdrawn) A write head for point recording on a pre-magnetized, moving medium, said medium having a medium movement direction, a surface and a recording layer that is pre-magnetized with a perpendicular pre-magnetization vector in a direction perpendicular to the surface of said medium, said write head comprising:

- a single pole write element having a write pole with a center, said write element being comprised of soft magnetic material and being supplied with current to produce a basic magnetic field diverging from the tip of said write pole; and

- a multitude of permanent magnets surrounding the write pole, with respective magnetization vectors of said permanent magnets having components in a plane parallel with the surface of said medium that are essentially radial to the center of said write pole and in sum essentially equal to zero to produce a stray field in a direction opposite to the direction of said perpendicular pre-magnetization vector, with a sum of said basic magnetic field and said stray magnetic field forming a write field for perpendicular recording on said recording medium.

Claim 17 has been amended as follows

17. (Currently amended) A write head for point recording on a pre-magnetized, moving medium, said medium having a medium movement direction, a surface and a recording layer that is pre-magnetized with a perpendicular pre-

magnetization vector in a direction perpendicular to the surface of said medium, said write head comprising:

- a single pole write element having a write pole with a center, said write element being comprised of soft magnetic material and being supplied with current modulated with information to produce a basic magnetic field, embodying said information, diverging from the tip of said write pole; and

- a multitude of wedge shaped permanent magnets sectioned into the soft magnetic material, converging at the center of said write pole, with respective magnetization vectors of said permanent magnets ~~having~~ comprising magnetization components in a plane parallel with the surface of said medium that are essentially radial to the center of said write pole and in sum essentially equal to zero to produce a stray field in a direction opposite to the direction of said perpendicular pre-magnetization vector, with a sum of said basic magnetic field and said stray magnetic field forming a write field for perpendicular recording of said information on said recording medium.

18. (Withdrawn) A write head for unidirectional point overwriting on a moving medium, said medium having a surface and a recording layer, said medium moving in a single medium movement direction, said write head comprising:

- a single pole write element having a write pole, said write element being composed of soft magnet material, and being supplied with current to produce a basic magnetic field;

a first multitude of permanent magnets respectively disposed surrounding said write pole with respective magnetization vectors of said permanent magnets having components in a plane parallel with the surface of said medium that are essentially radial to the center of said write pole and in sum essentially equal to zero, said first multitude of permanent magnets producing a first stray magnetic field and the permanent magnets thereof being composed of permanent magnetic material selected so that a combination of said basic magnetic field and said first stray magnetic field perpendicularly magnetizes said recording layer with a strength sufficient for recording on said recording medium only for a predetermined current supplied to said write element, and so that substantially no erasure in said recording layer occurs when said write element is supplied with no current or a current that is negative relative to said predetermined current; and

a second multitude of permanent magnets disposed preceding said write element relative to said medium movement direction, the permanent magnets in said second multitude of permanent magnets having respective magnetization vectors of said permanent magnets having components in a plane parallel with the surface of said medium that are essentially radial to the center of said second multitude of permanent magnets and in sum essentially equal to zero, and the respective magnetizations of the permanent magnets in said second multitude being oriented oppositely to the respective magnetizations of the permanent magnets in said first multitude, said second multitude

producing a second stray magnetic field and the permanent magnets thereof being composed of permanent magnetic material selected so that said second stray field has a strength sufficient to perpendicularly magnetize said recording layer in said recording medium for recording on said recording medium.

Claim 19 has been amended as follows

19. (Currently amended) A write head for unidirectional point overwriting on a moving medium, said medium having a surface and a recording layer, said medium moving in a single medium movement direction, said write head comprising:

a single pole write element having a write pole, said write element being composed of soft magnet material, and being supplied with current modulated with information to produce a basic magnetic field embodying said information;

a first multitude of wedge shaped permanent magnets sectioned into the soft magnetic material, converging at the center of said write pole with respective magnetization vectors of said permanent magnets having components in a plane parallel with the surface of said medium that are essentially radial to the center of said write pole and in sum essentially equal to zero, said first multitude of permanent magnets producing a first stray magnetic field and the permanent magnets thereof being composed of permanent magnetic material selected so that a combination of said basic magnetic field and said first stray magnetic field perpendicularly magnetizes said recording layer with a strength sufficient for recording said information on said recording medium only

for a predetermined current supplied to said write element, and so that substantially no erasure in said recording layer occurs when said write element is supplied with no current or a current that is negative relative to said predetermined current; and

a second multitude of permanent magnets disposed preceding said write element relative to said medium movement direction, the permanent magnets in said second multitude of permanent magnets having respective magnetization vectors of said permanent magnets having components in a plane parallel with the surface of said medium that are essentially radial to the center of said second multitude of permanent magnets and in sum essentially equal to zero, and the respective magnetizations of the permanent magnets in said second multitude being oriented oppositely to the respective magnetizations of the permanent magnets in said first multitude, said second multitude producing a second stray magnetic field and the permanent magnets thereof being composed of permanent magnetic material selected so that said second stray field has a strength sufficient to perpendicularly magnetize said recording layer in said recording medium for recording said information on said recording medium.

20. (Withdrawn) A write head for bi-directional point overwriting of a perpendicularly magnetized recording layer of a recording medium moving in a medium movement direction, comprising:

a first single pole write element having a write pole, said first single pole write element being composed of soft magnetic material and being supplied with current to produce a basic magnetic field diverging from the tip of said write pole, and a first multitude of permanent magnets respectively disposed surrounding said write pole with respective magnetization vectors of said permanent magnets having components in a plane parallel with the surface of said medium that are essentially radial to the center of said write pole and in sum essentially equal to zero, said permanent magnets producing a stray magnetic field, with a sum of said basic magnetic field and said stray magnetic field forming a write field for perpendicular recording on said recording medium;

a second single pole write element having a write pole, said second single pole write element being composed of soft magnetic material, and a second multitude of permanent magnets respectively disposed surrounding said write pole with respective magnetization vectors of said permanent magnets having components in a plane parallel with the surface of said medium that are essentially radial to the center of said write pole and in sum essentially equal to zero, said permanent magnets producing a stray magnetic field, with a sum of said basic magnetic field and said stray magnetic field forming a write field for perpendicular recording on said recording medium; and



the respective magnetizations of the permanent magnets in said first multitude of permanent magnets being oriented oppositely to the respective magnetizations of the permanent magnets in said second multitude of permanent magnets.

Claim 21 has been amended as follows

21. (Currently amended) A write head for bi-directional point overwriting of a perpendicularly magnetized recording layer of a recording medium moving in a medium movement direction, comprising:

a first single pole write element having a write pole, said first single pole write element being composed of soft magnetic material and being supplied with current modulated with information to produce a basic magnetic field, embodying said information, diverging from the tip of said write pole, and a first multitude of wedge shaped permanent magnets sectioned into the soft magnetic material, converging at the center of said write pole with respective magnetization vectors of said permanent magnets having components in a plane parallel with the surface of said medium that are essentially radial to the center of said write pole and in sum essentially equal to zero, said permanent magnets producing a stray magnetic field, with a sum of said basic magnetic field and said stray magnetic field forming a write field for perpendicular recording said information on said recording medium;

a second single pole write element having a write pole, said second single pole write element being composed of soft magnetic material and being supplied with said current to produce a basic magnetic field, embodying said information, diverging from the tip of said write pole, and a second multitude of wedge shaped permanent magnets sectioned into the soft magnetic material, converging at the center of said write pole with respective magnetization vectors of said permanent magnets having components in a plane parallel with the surface of said medium that are essentially radial to the center of said write pole and in sum essentially equal to zero, said permanent magnets producing a stray magnetic field, with a sum of said basic magnetic field and said stray magnetic field forming a write field for perpendicular recording said information on said recording medium; and

the respective magnetizations of the permanent magnets in said first multitude of permanent magnets being oriented oppositely to the respective magnetizations of the permanent magnets in said second multitude of permanent magnets.

22-25. (Cancelled)